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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

First Named Inventor : Ikko Fushiki et al.	Appeal No. ---
Appln. No. : 09/452,658	
Filed : December 1, 1999	Group Art Unit: 2672
For : METHOD AND APPARATUS FOR TRANSFORMING AND RENDERING GRAPHICAL CURVES	Examiner: Thu-Thao Havan
Docket No.: M61.12-0179	

BRIEF FOR APPELLANT

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PATENT ATTORNEY

Sir:

This is an appeal from an Office Action dated April 23, 2003 in which claims 1, 3-9, 21, 22 and 24-26 were finally rejected and claims 2, 10-20, 23 and 27-30 were objected to as being dependent upon a rejected base claim.

REAL PARTY IN INTEREST

Microsoft Corporation, a corporation organized under the laws of the state of Washington, and having offices at One Microsoft Way, Redmond, Washington 98052, has acquired the entire right, title and interest in and to the invention, the application, and any and all patents to be obtained therefor, as set forth in the Assignment filed with the patent application and recorded on Reel 010606, frame 0697.

RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF THE CLAIMS

Claims cancelled:	---
Claims withdrawn but not cancelled:	---
Claims pending:	1-38
Claims allowed:	31-38
Claims rejected:	1, 3-9, 21, 22 and 24-26
Claims objected to:	2, 10-20, 23, and 27-30
Claims on appeal:	1-30

STATUS OF AMENDMENTS

There have been no amendments after the Final Office Action of April 23, 2003.

SUMMARY OF INVENTION

The invention is directed to performing non-affine transforms on a base image to produce a transformed image. Non-affine transforms are complex transforms in which parallel lines in the base image do not necessarily remain parallel in the transformed image. They differ from affine transforms such as scaling, skewing, rotation, and translation (movement) in which parallel lines in the base image remain parallel in the transformed image.

For affine transforms, the prior art has performed transforms on individual pixels in the base image and on functions that represent multiple pixels in the base image. However, due to the complexity of non-affine transforms, non-affine transforms have only been performed on individual pixels of the base image and not on equations representing more than one pixel in the image.

The present invention provides a means for performing a non-affine transform on a function that represents multiple pixels in a base image instead of transforming the individual pixels of the base image. For example, as shown on page 9, the present invention performs a non-affine transform on the functions of equations 13 and 14, which represent multiple pixels in an image

to produce a pair of transformed functions represented by equations 17 and 18. As noted on page 10, lines 18-20, the particular non-affine transform on page 9, known as a bilinear transform, transforms an equation of order *n* into an equation of order 2*n*. For example, as seen in FIGS. 5A and 5B, an equation representing a straight line is transformed into an equation representing a smooth curve.

Another example of a non-affine transform of functions under the present invention is a non-affine perspective transform in which a two-dimensional image is transformed into a three-dimensional image and then the three-dimensional image is projected onto a two-dimensional surface. (See pages 11-12) Under the present invention, this transform is applied to functions representing multiple pixels of the base image to produce transformed functions that are the ratio of two linear functions. Thus, if the base image functions are of order n, the transformed functions are rational functions of order n.

ISSUES

Are claims 1, 3-9, 21-22, and 24-26 obvious from Sayre(U.S. Patent No. 5,175,808) in view of statements in the Background section of the present application?

GROUPING OF CLAIMS

The following groupings of claims are made solely in the interest of consolidating issues and expediting this Appeal. No grouping of claims is intended to be nor should be interpreted as being any form of admission or a statement as to the scope or obviousness of any limitation.

Group I:	Claims 1, 2, 3, 5, 6 and 9-20
Group II:	Claim 4
Group III:	Claim 7
Group IV:	Claim 8
Group V:	Claims 21-23 and 26-30

Group VI:	Claim 24
Group VII:	Claim 25

ARGUMENT

Group I: Claims 1, 2, 3, 5, 6 and 9-20

In the Final Office Action, claims 1, 3, 5, 6 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sayre (U.S. Patent No. 5,175,808) in view of Appellant's statements in the Background section of the present application. Claims 2 and 10-20 were objected to as being dependent upon a rejected base claim.

Sayre discloses a system for performing non-affine transforms on a pixel-by-pixel basis. Due to the complexity of performing non-affine transforms, Sayre divides the transforms into an x component and a y component. It then generates two displacement tables X and Y. The X displacement table indicates how each pixel in the source image should be displaced in the x direction based on the non-affine transform. The Y displacement table indicates how each pixel in the source image should be displaced in the y direction based on the non-affine transform. Each pixel in the source image is then applied to the X displacement table to produce a temporary table that includes pixel values that represent the displacement of the pixels along the x direction. The Y displacement table is then applied to the X displacement table to provide a modified Y displacement table. The pixels in the temporary table are then applied to the modified Y displacement table to form a destination table of pixels. Note that each transformation is done on a pixel-by-pixel basis. The resulting destination table is ready for rendering simply by using the pixel values in the table.

Independent clam 1 of the present application is directed to a method of displaying an image on a screen by describing at least a portion of a base image as a path, where

the path represents multiple pixels. A non-affine transform is performed on the path instead of the multiple pixels represented by the path to produce a transformed path. The transformed path is then rendered onto a computer screen.

In the Final Office Action, it was asserted that Sayre shows describing at least a portion of a base image as a path and performing a non-affine transform on the path instead of the individual pixels represented by the path at column 6, line 50 to column 7, line 36 and at column 11, line 45 to column 14, line 15. In an Advisory Action dated July 24, 2003, the Examiner asserted that Sayre teaches performing a non-affine transform on the path when he discloses non-affine warping at col. 11, lines 47-53, and col. 7 line 48 to col. 9, line 65. Appellants dispute these assertions.

In the cited section from column 6, line 50 to column 7, line 36, Sayre shows a way of defining a non-affine transform without needing to formulate a function that represents the transform. To do this, Sayre provides a graphical interface that shows individual knots connected by lines. The user is able to define the transform by moving the knots. Note that moving the knots does not involve transforming a base image. Instead, it is simply a tool for defining the transform that will be applied to a base image later. This is made clear at column 7, lines 29-36 where Sayre states:

> Once a mathematical function has been defined or knots have been moved and an approximating spline generated, then a displacement map is derived from the mathematical mapping, or model. The displacement map generated describes an X direction displacement and a Y direction displacement for each pixel in the source image. The displacement map contains displacement information to sub-pixel accuracy.

Thus, the knots define a spline and the spline defines displacement maps. These maps are applied to a base image on a pixel-by-pixel basis to transform the base image. Thus, the cited section clearly shows that Sayre does not transform a path that represents multiple pixels but instead transforms individual pixels using displacement maps.

The cited section from column 7, line 48 to column 9, line 65 discusses an optimization technique that is used to decide whether to perform the X transform on each of the pixels before the Y transform or whether to perform the Y transform on each of the pixels before the X transform and whether the images and tables should be "transposed" before the X and Y transforms are applied.

This section makes no mention of transforming a path representing multiple pixels of an image to form a transformed path. In fact, the cited section makes it clear that the transforms are performed on a pixel-by-pixel basis. For example, at column 7, lines 54-56, Sayre indicates that the order of the transforms can be determined on a pixel-by-pixel basis. Thus, at each pixel, Sayre determines the order of transforms to be applied to the pixel. Thus, it is clear that Sayre is performing pixel-by-pixel transforms and not transforms on paths representing multiple pixels.

The cited section from column 11, line 45 to column 14, line 15, which covers the claims, fails to show the non-affine transform of a path rather than the pixels represented by the path. In each claim, Sayre describes a system that transforms a "plurality of points" of a source image by applying an X displacement table to "each point of said source image". Thus, it is clear that Sayre is performing a pixel-by-pixel transform of the source image in the claims.

Note that the section at column 11, lines 47-53 does not change the fact that Sayre is perfoming pixel-by-pixel

transforms. In the cited section, Sayre indicates that each pixel is represented by an X value and a Y value. It does not state that multiple pixels are represented by a path. It is simply stating that each pixel is defined by two coordinates that give its location in the image. As such, this section does not show the transform of a path representing multiple pixels.

Thus, none of the cited sections show or suggest performing a transform on a path representing multiple pixels. Instead, Sayre reinforces the idea that before the present invention it was generally believed that non-affine transforms had to be performed on a pixel-by-pixel basis. The Sayre system is exactly the type of system that is alluded to in the background section of the present application in which non-affine transforms were only performed under the prior art by performing pixel-by-pixel transforms. This has been the state of the art even though it has been known to perform affine transforms on paths rather than on individual pixels. The reason for this is that performing non-affine transforms is quite complicated as indicated by the numerous equations in the present application and the numerous tables used by Sayre to perform a non-affine transform on a pixel-by-pixel basis.

In addition, Sayre indicates that there is a distinction in the art between affine and non-affine transforms. First, at column 2, lines 4-10, Sayre indicates that an affine transform is a "very simple transform". Second, Sayre notes that once the system moves away from affine transforms to non-affine transforms, the mapping functions, even on a pixel-by-pixel basis, become much more complicated in that performing pixel-by-pixel non-affine transforms creates artifacts, blurring, bottlenecks, and other problems. (See column 3, lines 15-17).

Thus, nothing in the cited sections of Sayre shows or suggests performing a non-affine transform on a path that describes a portion of a base image instead of the individual

pixels represented by the path and in fact, Sayre shows that the prior art used pixel-by-pixel operations for non-affine transforms.

As such, claim 1 and claims 2, 3, 5, 6 and 9-20, which depend therefrom, are patentable over Sayre and the statements in the Background section of the present application.

Group II: Claim 4

Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sayre in view of the statements in the Background section of the present application. Claim 4 depends from claim 3 but stands apart from claim 3 because it includes a further limitation wherein the transform is a bilinear transform that produces a transformed function of order 2n, which is not shown or suggested in the cited art.

The Office Action rejected claim 4 by stating that "Sayre discloses a portion of the base image as a path comprises describing the portion using a function of order n and 2n(column 1, lines 46-62)." Applicants respectfully dispute this assertion.

The cited section discusses possible transforms that can be applied to a pixel. However, it does not specifically mention a bilinear transform. In addition, it does not show or suggest that applying a non-affine transform to a path of order n would result in a transformed function of order 2n.

Similarly, the Background section of the present application indicates that non-affine transforms were not applied to paths under the prior art and as such does not show a transformed function of order 2n formed by applying a non-affine transform to a path.

As such, the combination of Sayre and the statements in the Background of the present application does not show or suggest the invention of claim 4.

Group III: Claim 7

Claim 7 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sayre in view of the statements in the Background section of the present application. Claim 7 depends from claim 1 but stands apart from claim 1 because it includes a further limitation wherein the transform is a perspective transform, which is not shown or suggested in the cited art.

In the Final Office Action, column 1, lines 46-62 of Sayre were cited as showing a perspective transform. The cited section discusses warping functions and states that such functions can be "wholly arbitrary functions." However, it does not specifically describe a perspective transform. Further, there is no suggestion in either Sayre or the Background of the present application to apply a perspective transform to a path representing multiple pixels of an image. As such, the application of a perspective transform to a path as found in claim 7 is patentable over the combination of Sayre and the statements in the Background of the present application.

Group IV: Claim 8

Claim 8 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sayre in view of the statements in the Background section of the present application. Claim 8 depends from claim 7 but stands apart from claim 7 because it includes a further limitation wherein the transform produces a rational function of order n, which is not shown or suggested in the cited art.

The Office Action rejected claim 4 by stating that "Sayre discloses a portion of the base image as a path comprises describing the portion using a function of order n and 2n(column 1, lines 46-62)."

This statement has no connection to claim 8 and does not address the limitation to claim 8 wherein the non-affine

perspective transform produces a rational function of order n. Further, the cited section of Sayre makes no mention of forming a rational function of order n by applying a perspective transform to a path.

Since neither Sayre nor the statements in the Background section of the present invention suggest producing a rational function of order n by applying a perspective transform to a path, their combination does not show or suggest the invention of claim 8.

Group V: Claims 21-23 and 26-30

In the Final Office Action, claims 21, 22, and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sayre in view of Applicant's statements in the Background section of the present application. Claims 23 and 27-30 were objected to for being dependent upon a rejected base claim.

Independent claim 21 recites a computer-readable medium having computer executable components for performing steps comprising generating a function to describe multiple pixels of an image for a computer screen; transforming the function using a non-affine transform to produce a transformed function; and converting the transformed function into an image on the computer screen.

The claims of Group V stand apart from the claims of Group I because the wording of claim 21 is different than the wording of claim 1 and Appellants wish to have a separate determination of the patentability of the claims of Group V based on the wording used in Group V.

As noted above, neither Sayre nor the prior art discussed in the Background of the present application show a technique for transforming a representation of multiple pixels of an image using a non-affine transform instead of transforming the individual pixels. As such, the cited art does not show or

suggest performing a non-affine transform of a function that describes multiple pixels instead of the multiple pixels as found in claim 21.

In addition, transforming a function using a non-affine transform was not obvious from the prior art since non-affine transforms are much more complex than affine transforms, and the art had not been able to find a way to perform non-affine transforms of functions. As a result, the prior art, as clearly shown in Sayre, was forced to perform pixel-by-pixel transforms to obtain non-affine transforms. (See Sayre at column 7 lines 29-36 and lines 54-56).

Since neither Sayre nor the Background section of the present application show or suggest that the prior art applied non-affine transforms to functions that represent multiple pixels of an image, their combination does not show or suggest the invention of claim 21 or claims 22, 23 and 26-30, which depend therefrom.

Group VI: Claim 24

Claim 24 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sayre in view of the statements in the Background section of the present application. Claim 24 depends from claim 23 but stands apart from claim 23 because it includes a further limitation wherein transforming a function involves transforming a function of order n to form a function of order 2n, which is not shown or suggested in the cited art.

The Office Action rejected claim 24 by stating that "Sayre discloses a portion of the base image as a path comprises describing the portion using a function of order n and 2n(column 1, lines 46-62)." Applicants respectfully dispute this assertion.

The cited section discusses possible transforms that can be applied to a pixel. However, it does not show or suggest

applying a non-affine transform to a function and in particular does not show or suggest applying a non-affine transform to a function of order n to produce a transformed function of order 2n.

Similarly, the Background section of the present application indicates that non-affine transforms were not applied to functions under the prior art and as such does not show a transformed function of order 2n formed by applying a non-affine transform to a function or order n.

As such, the combination of Sayre and the statements in the Background of the present application does not show or suggest the invention of claim 24.

<u>Group VII: Claim 25</u>

Claim 25 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sayre in view of the statements in the Background section of the present application. Claim 25 depends from claim 21 but stands apart from claim 21 because it includes a further limitation wherein transforming a function comprises using a perspective transform, which is not shown or suggested in the cited art.

In the Final Office Action, column 1, lines 46-62 of Sayre were cited as showing a perspective transform. The cited section discusses warping functions and states that such functions can be "wholly arbitrary functions." However, it does not specifically describe a perspective transform. Further, there is no suggestion in either Sayre or the Background of the present application to apply a perspective transform to a function as found in claim 25. As such, the application of a perspective transform to a function as found in claim 25 is patentable over the combination of Sayre and the statements in the Background of the present application.

CONCLUSION

From the remarks above, it is clear that the invention in claims 1-30 is not shown or suggested in the combination of Sayre and the statements made in the Background of the present application. As such, Appellants request that the Examiner's rejections and objections to these claims be reversed.

Respectfully submitted,

WESTMAN, CHAMPLIN & KELLY, P.A.

By: ______________________________

Theodore M. Magee, Reg. No. 39,758
Suite 1600 - International Centre
900 Second Avenue South
Minneapolis, Minnesota 55402-3319
Phone:(612) 334-3222 Fax:(612) 334-3312

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Appendix A

Claims on Appeal

1. A method of displaying an image on a computer screen, the method comprising:

describing at least a portion of a base image as a path, the path representing multiple pixels;

performing a non-affine transform on the path instead of the multiple pixels represented by the path to produce a transformed path; and

rendering the transformed path onto the computer screen.

2. The method of claim 1 wherein performing a non-affine transform comprises performing a bilinear transform.

3. The method of claim 2 wherein describing the portion of the base image as a path comprises describing the portion using a function of order n.

4. The method of claim 3 wherein performing a bilinear transform produces a transformed function of order 2n.

5. The method of claim 3 wherein describing the portion of the base image as a path comprises describing the portion as a function of order one.

6. The method of claim 3 wherein describing the portion of the base image as a path comprises describing the portion as a function of order three.

7. The method of claim 1 wherein performing a non-affine transform comprises performing a perspective transform.

8. The method of claim 7 wherein performing a perspective transform produces a rational function of order n.

9. The method of claim 1 wherein rendering the transformed path comprises approximating the transformed path as a series of lines and rendering each line in the series of lines.

10. The method of claim 9 wherein producing a transformed path comprises producing a path of the form $\sum_{i=0}^{n} B_i^n(t)\mathbf{q}_i$ where t is between zero and one and wherein approximating the transformed path as a series of lines comprises:

converting the transformed path from a function that describes an entire curve to a function of the form $\sum_{j=0}^{n} B_j^n(t)\tilde{\mathbf{q}}_j$ that describes a segment of the curve by setting each $\tilde{\mathbf{q}}_j = \sum_{i=0}^{j} B_i^j(c)\mathbf{q}_i$ where c is a fixed fraction; and

determining if the segment of the curve can be replaced by a straight line based on the function that describes the segment.

11. The method of claim 10 wherein approximating the transformed path as a series of lines further comprises:

converting a function of the form $\sum_{i=0}^{n} B_i^n(t)\mathbf{q}_i$ that describes a segment of the curve into a function

of the form $\sum_{j=0}^{n} B_j^n(t)\tilde{\mathbf{q}}_j$ that describes a larger segment of the curve by setting each $\tilde{\mathbf{q}}_j = \sum_{i=0}^{j} B_i^j(d)\mathbf{q}_i$ where d is a fixed value that is greater than one; and

determining if the larger segment of the curve can be replaced by a straight line based on the function that describes the segment.

12. The method of claim 10 wherein approximating the transformed path as a series of lines further comprises:

converting a function of the form $\sum_{i=0}^{n} B_i^n(t)\mathbf{q}_i$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n} B_j^n(t)\tilde{\mathbf{q}}_j$ that describes a neighboring segment of the curve by setting each $\tilde{\mathbf{q}}_j = \sum_{i=n-j}^{n} (-1)^{n-i}\binom{j}{n-i}2^{j-(n-i)}\mathbf{q}_i$; and

determining if the neighboring segment of the curve can be replaced by a straight line based on the function that describes the segment.

13. The method of claim 9 wherein producing a transformed path comprises producing a path of the form $\mathbf{r} = \sum_{i=0}^{n} \mathbf{a}_i t^i$ where t is between zero and one and wherein approximating the transformed path as a series of lines comprises:

converting the transformed path from a function that describes an entire curve to a function of the

form $\sum_{j=0}^{n} \tilde{a}_j t^j$ that describes a segment of the curve by setting each $\tilde{a}_j = c^j a_j$ where c is a fixed fraction; and

determining if the segment of the curve can be replaced by a straight line based on the function that describes the segment.

14. The method of claim 13 wherein approximating the transformed path as a series of lines further comprises:

converting a function of the form $\sum_{i=0}^{n} \mathbf{a}_i t^i$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n} \tilde{a}_j t^j$ that describes a larger segment of the curve by setting each $\tilde{a}_j = d^j a_j$ where d is a fixed value that is greater than one; and

determining if the larger segment of the curve can be replaced by a straight line based on the function that describes the segment.

15. The method of claim 13 wherein approximating the transformed path as a series of lines further comprises:

converting a function of the form $\sum_{i=0}^{n} a_i t^i$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n} \tilde{a}_j t^j$ that describes a neighboring segment of the curve by setting each $\tilde{a}_j = \sum_{i=j}^{n} \frac{i!}{j!(i-j)!} a_i$; and

determining if the neighboring segment of the curve can be replaced by a straight line based on the function that describes the segment.

16. The method of claim 1 wherein performing a non-affine transform and rendering the transformed path comprise:

issuing a call to a server process while passing parameters comprising the path of the base image and a type of non-affine transform; and

processing the call in the server process by performing the transform and rendering the transformed path.

17. The method of claim 16 wherein issuing a call to a server process further comprises passing parameters further comprising corner points for a quadrilateral that defines a transform space.

18. The method of claim 17 wherein issuing a call to a server process further comprises passing parameters further comprising a pen style to be used during rendering.

19. The method of claim 17 wherein passing a path comprises passing a list of paths.

20. The method of claim 19 wherein issuing a call to a server process further comprises passing parameters further comprising a brush style for filling a space between at least two rendered transformed paths.

21. A computer-readable medium having computer-executable components for performing steps comprising:

generating a function to describe multiple pixels of an image for a computer screen;

transforming the function instead of the multiple pixels using a non-affine transform to produce a transformed function; and

converting the transformed function into an image on the computer screen.

22. The computer-readable medium of claim 21 wherein transforming the function comprises transforming a function representing a smooth curve.

23. The computer-readable medium of claim 21 wherein transforming the function comprises using a bilinear transform.

24. The computer-readable medium of claim 23 wherein generating a function to describe an image comprises generating a function of order n and wherein transforming the function produces a transformed function of order 2n.

25. The computer-readable medium of claim 21 wherein transforming the function comprises using a perspective transform.

26. The computer-readable medium of claim 21 wherein converting the transformed function into an image comprises converting the transformed function into a series of lines and converting each line into an image.

27. The computer-readable medium of claim 26 wherein converting the transformed function into a series of lines comprises:

converting a function of the form $\sum_{i=0}^{n} \frac{n!}{i!\,(n-i)!} t^i (1-t)^{n-i} \mathbf{q}_i$ that describes a segment of a curve represented by

the transform function into a function of the form $\sum_{j=0}^{n}\frac{n!}{j!\,(n-j)!}t^{j}(1-t)^{n-j}\tilde{\mathbf{q}}_{j}$ that describes a different sized segment of the curve by setting each $\tilde{\mathbf{q}}_{j}=\sum_{i=0}^{j}\frac{j!}{i!\,(j-i)!}c^{i}(1-c)^{j-i}\mathbf{q}_{i}$ where c is a fixed value; and

determining if the different sized segment of the curve can be replaced by a straight line based on the function that describes the segment.

28. The computer-readable medium of claim 26 wherein converting the transformed function into a series of lines comprises:

converting a function of the form $\sum_{i=0}^{n}\frac{n!}{i!\,(n-i)!}t^{i}(1-t)^{n-i}\mathbf{q}_{i}$ that describes a segment of a curve represented by the transform function into a function of the form $\sum_{j=0}^{n}\frac{n!}{j!\,(n-j)!}t^{j}(1-t)^{n-j}\tilde{\mathbf{q}}_{j}$ that describes an adjoining segment of the curve by setting each $\tilde{\mathbf{q}}_{j}=\sum_{i=n-j}^{n}(-1)^{n-i}\binom{j}{n-i}2^{j-(n-i)}\mathbf{q}_{i}$; and

determining if the adjoining segment of the curve can be replaced by a straight line based on the function that describes the segment.

29. The computer-readable medium of claim 26 wherein converting the transformed function into a series of lines comprises:

converting a function of the form $\sum_{i=0}^{n} \mathbf{a}_i t^i$ that describes a segment of a curve represented by the transform function into a function of the form $\sum_{j=0}^{n} \tilde{a}_j t^j$ that describes a different sized segment of the curve by setting each $\tilde{a}_j = c^j a_j$ where c is a fixed value; and

determining if the different sized segment of the curve can be replaced by a straight line based on the function that describes the segment.

30. The computer-readable medium of claim 26 wherein converting the transformed function into a series of lines comprises:

converting a function of the form $\sum_{i=0}^{n} a_i t^i$ that describes a segment of a curve represented by the transform function into a function of the form $\sum_{j=0}^{n} \tilde{a}_j t^j$ that describes an adjoining segment of the curve by setting each $\tilde{a}_j = \sum_{i=j}^{n} \frac{i!}{j!(i-j)!} a_i$; and

determining if the adjoining segment of the curve can be replaced by a straight line based on the function that describes the segment.

31. A method for rendering a curve on a computer screen comprising:

converting a function of the form $\sum_{i=0}^{n}\frac{n!}{i!\,(n-i)!}t^{i}(1-t)^{n-i}\mathbf{q}_{i}$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n}\frac{n!}{j!\,(n-j)!}t^{j}(1-t)^{n-j}\tilde{\mathbf{q}}_{j}$ that describes a different sized segment of the curve by setting each $\tilde{\mathbf{q}}_{j}=\sum_{i=0}^{j}\frac{j!}{i!\,(j-i)!}c^{i}(1-c)^{j-i}\mathbf{q}_{i}$ where c is a fixed value that determines the segment size;

determining if the different sized segment of the curve can be replaced by a straight line based on the function that describes the segment; and

rendering the straight line onto the computer screen if the straight line replaced the segment.

32. A method for rendering a curve on a computer screen comprising:

converting a function of the form $\sum_{i=0}^{n}\frac{n!}{i!\,(n-i)!}t^{i}(1-t)^{n-i}\mathbf{q}_{i}$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n}\frac{n!}{j!\,(n-j)!}t^{j}(1-t)^{n-j}\tilde{\mathbf{q}}_{j}$ that describes an adjacent segment of the curve by setting each $\tilde{\mathbf{q}}_{j}=\sum_{i=n-j}^{n}(-1)^{n-i}\binom{j}{n-i}2^{j-(n-i)}\mathbf{q}_{i}$;

determining if the adjacent segment of the curve can be replaced by a straight line based on the function that describes the segment; and

rendering the straight line onto the computer screen if the straight line replaced the segment.

33. A method for rendering a curve on a computer screen comprising:

converting a function of the form $\sum_{i=0}^{n} \mathbf{a}_i t^i$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n} \tilde{\boldsymbol{a}}_j t^j$ that describes a different sized segment of the curve by setting each $\tilde{\boldsymbol{a}}_j = c^j \boldsymbol{a}_j$ where c is a fixed value that determines the segment size;

determining if the different sized segment of the curve can be replaced by a straight line based on the function that describes the segment; and

rendering the straight line onto the computer screen if the straight line replaced the segment.

34. A method for rendering a curve on a computer screen comprising:

converting a function of the form $\sum_{i=0}^{n} \boldsymbol{a}_i t^i$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n} \tilde{\boldsymbol{a}}_j t^j$ that describes an adjacent segment of the curve by setting each $\tilde{\boldsymbol{a}}_j = \sum_{i=j}^{n} \frac{i!}{j!(i-j)!} \boldsymbol{a}_i$;

determining if the adjacent segment of the curve can be replaced by a straight line based on the function that describes the segment; and

rendering the straight line onto the computer screen if the straight line replaced the segment.

35. A computer-readable medium having computer-executable components for performing steps comprising:

converting a function of the form $\sum_{i=0}^{n} \frac{n!}{i!\,(n-i)!} t^i (1-t)^{n-i} \mathbf{q}_i$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n} \frac{n!}{j!\,(n-j)!} t^j (1-t)^{n-j} \tilde{\mathbf{q}}_j$ that describes a different sized segment of the curve by setting each $\tilde{\mathbf{q}}_j = \sum_{i=0}^{j} \frac{j!}{i!\,(j-i)!} c^i (1-c)^{j-i} \mathbf{q}_i$ where c is a fixed value that determines the segment size;

determining if the different sized segment of the curve can be replaced by a straight line based on the function that describes the segment; and

rendering the straight line onto the computer screen if the straight line replaced the segment.

36. A computer-readable medium having computer-executable components for performing steps comprising:

converting a function of the form $\sum_{i=0}^{n} \frac{n!}{i!\,(n-i)!} t^i (1-t)^{n-i} \mathbf{q}_i$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n} \frac{n!}{j!\,(n-j)!} t^j (1-t)^{n-j} \tilde{\mathbf{q}}_j$ that describes an adjacent segment of the curve by setting each $\tilde{\mathbf{q}}_j = \sum_{i=n-j}^{n} (-1)^{n-i} \binom{j}{n-i} 2^{j-(n-i)} \mathbf{q}_i$;

determining if the adjacent segment of the curve can be replaced by a straight line based on the function that describes the segment; and

rendering the straight line onto the computer screen if the straight line replaced the segment.

37. A computer-readable medium having computer-executable components for performing steps comprising:

converting a function of the form $\sum_{i=0}^{n} \mathbf{a}_i t^i$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n} \tilde{\boldsymbol{a}}_j t^j$ that describes a different sized segment of the curve by setting each $\tilde{\boldsymbol{a}}_j = c^j \boldsymbol{a}_j$ where c is a fixed value that determines the segment size;

determining if the different sized segment of the curve can be replaced by a straight line based on the function that describes the segment; and

rendering the straight line onto the computer screen if the straight line replaced the segment.

38. A computer-readable medium having computer-executable components for performing steps comprising:

converting a function of the form $\sum_{i=0}^{n} \boldsymbol{a}_i t^i$ that describes a segment of the curve into a function of the form $\sum_{j=0}^{n} \tilde{\boldsymbol{a}}_j t^j$ that describes an adjacent segment of the curve by setting each $\tilde{\boldsymbol{a}}_j = \sum_{i=j}^{n} \frac{i!}{j!(i-j)!} \boldsymbol{a}_i$;

determining if the adjacent segment of the curve can be replaced by a straight line based on the function that describes the segment; and

rendering the straight line onto the computer screen if the straight line replaced the segment.

Appendix B

List of Cited References

Sayre U.S. Patent No. 5,175,808, Filed September 12, 1989

[General Notes]

3 copies of the brief must be filed.
Fee must be submitted with brief.
Send separate transmittal letter.